

## REMARKS

1. Claims 11 and 12 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention. Applicants have amended claims 11 and 12 to depend from claim 1. Thus, Applicants respectfully request the rejection be withdrawn.

2. Claims 1-9 and 11-25 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Lauritzen (U.S. Patent No. 4,761,394 (hereinafter “Lauritzen”)). This rejection is respectfully traversed. Applicants claimed method in the present application relates to a supported highly selective epoxidation catalyst comprising silver in a quantity of at most 0.17 g per m<sup>2</sup> surface area of the support and further comprising rhenium or compound thereof. The catalyst, or a precursor of the catalyst containing silver in cationic form, is contacted with a feed comprising oxygen at a catalyst temperature above 250 °C for a duration of at least 1 hour and up to 150 hours, and subsequently the catalyst temperature is decreased to a value of at most 250 °C.

As explained in the application text, as filed (page 3, line 19 – page 4, line 8), the present invention provides a heat-treating method specifically applicable to epoxidation catalysts having a selectivity enhancing dopant of rhenium and having a relatively low silver density. It has been found that the selectivity of the defined highly selective epoxidation catalyst can be improved by heat-treating the catalyst for an extended period of time (**beyond that required for decomposing/reducing the silver component to silver metal**) in the presence of oxygen at a temperature which is typically **above the catalyst’s normal initial operation temperature**.

Lauritzen discloses an ethylene oxide catalyst comprising silver, alkali metal, and rhenium deposited on a carrier. *See U.S. Patent No. 4,761,394*, col. 1, l. 67 – col. 2, l. 4. Lauritzen discloses heating impregnated carriers to a temperature between 50 and 600 °C to evaporate the liquid used to impregnate the carrier and to reduce the silver component to silver metal. *See Id.* at col. 13, ll. 3-11; col. 17, ll. 8-19. Table 2 of Lauritzen discloses catalyst temperatures ranging from 180 to 325 °C as being used in the commercial operation of ethylene oxide reactor units. This range covers catalyst temperatures over the entire epoxidation process. As the catalyst ages, higher temperatures are required to maintain levels of production. In Illustrative Embodiment I, Part D, Lauritzen also describes the

standard microreactor catalyst test conditions. As pointed out by the Examiner, the gas mixture contained 30% ethylene, 8.5% oxygen, 7% carbon dioxide, 54.5% nitrogen and 4.4 to 5.6 ppmv vinyl chloride. The initial microreactor temperature was 180 °C. The temperature was ramped up to 242 °C over the next several hours and then adjusted to achieve a constant oxygen conversion. The initial performance was obtained after the catalyst had been onstream for 16 +/- 4 hours.

Table 2 of Lauritzen merely teaches a range of catalyst temperatures that can be used during the course of the epoxidation process. Illustrative Embodiment 1 merely teaches the skilled person to ramp up the temperature from 180 to 242 °C and then adjust to a temperature for normal operation of the epoxidation process. Lauritzen does not teach or suggest to a person of ordinary skill in the art to heat-treat a highly selective catalyst comprising rhenium or compound thereof and silver in a quantity of at most 0.17 g/m<sup>2</sup> in the presence of oxygen at a catalyst temperature typically **above the catalyst's normal initial operation temperature** (i.e., heat to above 250 °C) and then decrease the catalyst temperature to a temperature used during normal operation of the epoxidation process (i.e., decrease to at most 250 °C).

**As shown in the working examples of the present application text as filed, it is surprising that heat-treating a catalyst, as defined in the claims, in the presence of oxygen for an extended period of time (beyond that required to decompose the silver precursor into silver metal) at a catalyst temperature above the catalyst's normal initial operation temperature (i.e., above 250 °C) would result in an improvement in the performance of the catalyst, in particular the selectivity.**

Examples 5-12 of the application text, as filed, demonstrate that after exposing a catalyst, as defined in the claims, (and which has already been heated at 250 °C for 5.5 minutes in air to decompose the silver precursor to silver metal) to an oxygen-containing feed stream at a catalyst temperature above the catalyst's normal initial operating temperature for an extended period of time, for example 4 to 24 hours, **the catalyst unexpectedly exhibits an improvement in selectivity** when it is subsequently used during normal operation in the epoxidation process. In particular, an improvement in selectivity was observed of 5.0 to 6.5 %-mole over the same catalyst that was not subjected to the heat-treatment (See Table A below).

Table A

Example	Duration (h) at 260 °C	Catalyst Temperature (°C)	Selectivity (%-mole)	Change in Selectivity relative to the base case with no heat treatment
5	0	226	83.5	---
6	4	237	88.8	5.3
7	12	245	89.4	5.9
8	24	252	89.8	6.3
9	0	230	83.0	---
10	4	237	88.0	5.0
11	12	247	89.5	6.5
12	24	242	89.5	6.5

These improvements in selectivity are completely unexpected in light of Lauritzen which does not provide any reason to heat the catalyst precursor beyond a period of time for decomposing/reducing the silver component to silver metal and does not provide any reason to heat the catalyst for an extended period of time at a catalyst temperature typically above the catalyst's normal initial operation temperature (i.e., heating above 250 °C) and then subsequently decrease the catalyst temperature to a temperature used during normal operation in the epoxidation process (i.e., decreasing to at most 250 °C). In view of these arguments, Applicants believe that claims 1-9 and 11-25 are non-obvious over Lauritzen. Applicants respectfully request that the rejection be withdrawn.

### **CONCLUSION**

Applicants respectfully request that the Examiner reconsider the present rejection in the light of the arguments presented in these remarks.

Allowance of the claims of the present application is respectfully requested. Should any fee be due in connection with the filing of this document, the Commissioner for Patents is hereby authorized to deduct said fee from Shell Oil Company, Deposit Account No. 19-1800.

If the Examiner would like to discuss this case with Applicant's attorney, the Examiner is invited to contact Lisa Holthus at the phone number below.

Respectfully submitted,

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